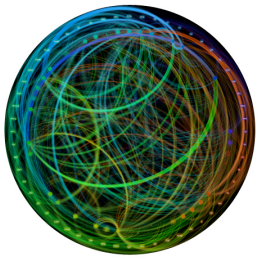
LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 26-30, 2012

POPSCI THE FUTURE NOW

VIRTUAL BRAIN, REAL RESEARCH



This network of neurosynaptic cores is derived from wiring in the monkey brain. Each core contains 256 neurons, 1024 axons, and 256×1024 synapses. Image courtesy of IBM.

The Sequoia supercomputer at Lawrence Livermore, the second most powerful supercomputer in the world, has simulated 10 billion neurons and 100 trillion connections among them -- the most powerful brain simulation ever. IBM and LLNL built a 2.084 billion neurosynaptic cores, which are an IBM-designed computer architecture that is designed to work like a brain.

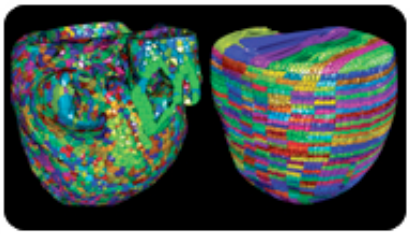
IBM was careful to say it didn't build a realistic simulated complete brain -- "Rather, we have simulated a novel modular, scalable, non-von-Neumann, ultra-low power, cognitive computing architecture," IBM researchers say.

It meets the Defense Advance Research Projects Agency's (DARPA) metric of 100 trillion synapses, which is based on the number of synapses in the human brain. This is part of DARPA's cognitive computing program, called Systems of Neuromorphic Adaptive Plastic Scalable Electronics (SyNAPSE).

The ultimate goal is a computer that works like a brain, and can analyze information in real time from multiple sources.

To read more, go to *Popular Science*.

SUPERCOMPUTER HAS MUSCLE TO SIMULATE A HEART



The Cardioid code divides the heart into a large number of manageable pieces, or subdomains.

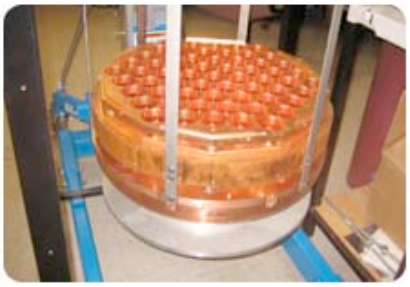
Lawrence Livermore and IBM researchers are using the Sequoia supercomputer and a code called Cardioid, for the first time, to model the beating of the human heart in real time.

The benefits of the advancement are many. Researchers can now run detailed models of the heart quickly enough to examine how potentially fatal arrhythmias develop. They can determine the influence of individual genetic variations.

Until recently, scientists didn't have the computing power needed to simulate the billions of muscle cells in a human heart. But Sequoia -- an IBM Blue Gene/Q supercomputer rated at more than 16 petaflops of performance -- has the muscle to make it happen.

To read more, go to HPC Wire.

DON'T BE AFRAID OF THE DARK



Side view of the LLNL-designed and built copper photomultiplier tube mounting structure, which is a key component of the Large Underground Xenon (LUX) detector.

Matter that is. Lawrence Livermore researchers are one step closer to finding one of nature's most elusive particles, "dark matter," by using a tank nearly a mile underground beneath the Black Hills of South Dakota.

The Large Underground Xenon (LUX) experiment located at the Sanford Underground Research Facility in Lead, S.D., is the most sensitive detector of its kind to look for dark matter.

Thought to comprise more than 80 percent of the mass of the universe, scientists believe dark matter could hold the key to answering some of the most challenging questions facing physicists in the 21st century. So far, however, dark matter has eluded direct detection. LLNL researchers have been involved in the LUX experiment since 2008.

"We now are part of a world-class team that stands an excellent chance of being the first to directly and unambiguously measure cosmological dark matter particle interactions in an earthly detector," said Adam Bernstein, who leads the advanced detectors group in LLNL's Physics Division.

To read more, go to Phys.org.

Image Credit: Lukiyanova Natalia

Finding bugs in supercomputers just became easier thanks to a new tool developed by Lawrence Livermore scientists to help discover and diagnose cyberbugs.

Called the Stack Trace Analysis Tool (STAT), this piece of software is lightweight, scalable and capable of finding bugs in a system while it's churning out more than 1 million MPI processes.

STAT is now being used to find bugs on the IBM BlueGene/Q-based supercomputer Sequoia, which recently ranked No. 2 in the Top 500 Supercomputers list.

Finding bugs while Sequoia is running fewer processes was difficult enough, but according to the research team for STAT, these bugs became more difficult to find and manifested themselves in some very perplexing ways once the computer began ramping up its processes. While the LLNL team began ramping up Sequoia, they began to notice some software defects as well as application failures. They began to use STAT and have since been able to diagnose and solve many of these issues.

To read more, go to Red Orbit.

KTVA 'FUN WITH SCIENCE' STIRS UP THE LAST FRONTIER

Nick Williams, during a Fun With Science presentation in Alaska.

Lawrence Livermore Discovery Center volunteer and retired engineer Nick Williams and Discovery Center docent Diane Nelson traveled north earlier this month to present "Fun with Science" to students living in Alaska, "The Last Frontier."

Fun with Science is a presentation of interactive experiments that encourage students to delve into science and engineering.

Williams and Nelson presented the shows for children in kindergarten through 12th grades in schools in Noorvick and Selawik, with both daytime and evening events.

For more, see the KTVA-CBS news clip.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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